



ZSK TECHNICAL EMBROIDERY SYSTEMS  
A DIVISION OF ZSK STICKMASCHINEN GMBH



# TECHNICAL EMBROIDERY SYSTEMS

MACHINES TO LAY AND EMBROIDER WIRES, FIBERS AND TUBES





FIXING THROUGH EMBROIDERING IS  
ONE OF THE MOST ACCURATE AND  
EFFICIENT PRODUCTION METHODS.

## **ZSK TECHNICAL EMBROIDERY SYSTEMS**

### **MACHINES TO LAY AND EMBROIDER FIBERS, WIRES AND TUBES**

The ZSK TECHNICAL EMBROIDERY SYSTEMS enables with the use of new and innovative techniques the laying and fixing of different media on textile and other flexible carrier material.

Media as wires and any kind of fibers, tubes and optical fibers can be layed flexible and will be fixed secure and strongly through embroidery techniques like the ZigZag stitch. Materials with different conditions like Polyamid, Polyester, PPS or Aramid are available as a yarn. For products with special load requirements yarns with a steel core can be used if applicable.



# METHODS

The different embroidery technologies used by ZSK TECHNICAL EMBROIDERY SYSTEMS enable through their typical individual characteristics a wide scope of products, applications and methodical procedures.

## Examples

- Integration of wire into fabrics for heating and sensing (e.g. moisture, temperature, stretch) applications.
- Embroidery with conductive yarn to create textile electrodes for body signal monitoring (e.g. ECG) or electro stimulation (EMS or TENS) or embroidered connectors between electronic parts and textiles (conductive paths and connection pads).
- Placement with Functional Sequin Devices (FSD) e.g. LED-sequins and automatic electrical connection obtained by embroidery with conductive threads.
- Production of near net shape composite preforms via Tailored Fiber Placement (TFP) of carbon roving.
- Fixation of fibrous material like carbon, glass, basalt, aramid, natural, thermoplastic, ceramic fibers as well as metallic threads and PCL, PVA, PA, PP, PVDF on textile and flexible carrier material in complex shapes for e.g. local reinforcement or material combination.

To obtain these vary widely applications ZSK TECHNICAL EMBROIDERY SYSTEMS provides machine with three different embroidery technologies. Each of these three technologies are obtained by a specific embroidery head (W-Head, F-Head and K-Head). This three different embroidery heads can be freely combined with each other on one machine, configured at the factory, the so-called combination machines. Common combinations are for example the combination of the W-Head for fiber or wire placement and the F- Head for standard embroidery as well as the K-Head for textile electrodes in combination with the F-Head.

### W-HEAD

ZSK's W-Head provides an often asked feature from the technical embroidery methods: the laying of fibers, wires and tubes onto textile or other flexible carrier material.

Embroidery technologies like the tailored wire, fiber and tube placement can be realized with this special head.



### F-HEAD

The F-Head is the most commonly used embroidery head at ZSK embroidery machines for "decorative" embroidery. Stitches like the double lock stitch or the satin stitch belongs to his qualities. More functional applications can be realized with unconventional threads like i.e. conductive yarn.



### K-HEAD

The K-Head facilitates the so-called moss embroidery. With only one thread the K-Head creates voluminous and soft surfaces.

In combination with conductive material, this special embroidery head is ideal for producing sensors or similar like they are required for smart or medical textiles.



# W-HEAD

## LAYING WIRES

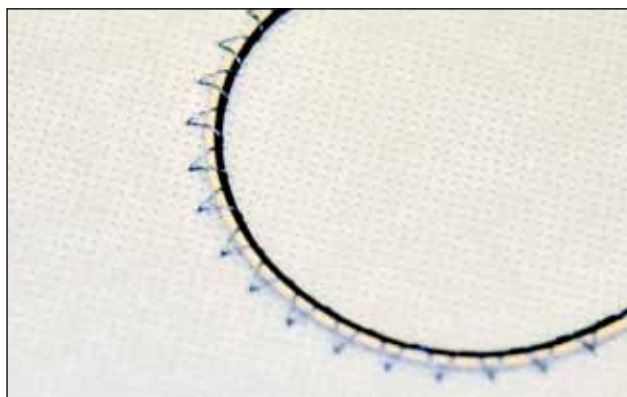
The laying of wire is an essential part in the production of many products from all spheres of life today. Laying wire with ZSK's Technical Embroidery Systems is cost efficient, reliable and environmentally friendly.

Today's most common application for laying of wires obtained by embroidery is the production of heated steering wheels with a market share of almost 100 % and heated car seats with a market share of over 10 %. Without any damage of the textiles characteristic especially the breathability and drapability, heating wires are placed on a textile substrate.

Laying wire with ZSK's Technical Embroidery Systems can be used for many other fields of application.

Exemplary products amongst others are:

- Heated working- or outdoor clothing,
- Infrared heating systems,
- Luminous textiles to improve security or comfort,
- Embroidered RFID antennas,
- Embroidered sensors on textiles for measurement of fill level, movement, temperature, moisture or stretch,
- Embroidered circuits to integrate electrical functions.

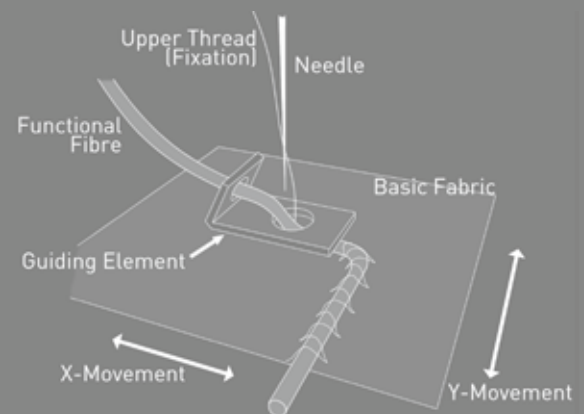


## PRINCIPLE OF W-HEAD

The material to lay is supplied by an active wire and fiber system to a guiding element close to the surface of the carrier material.

The media is finally fixed by embroidery and upper thread with a zigzag stitch.

The carrier material, fixed at the clamping and stretching system, is moved by the pantograph, enabling to lay e.g. rovings in any direction and quantity. The W-Head can process wires from 70 µm up to several mm thickness.



## ADVANTAGE SUPERIOR FLEXIBILITY

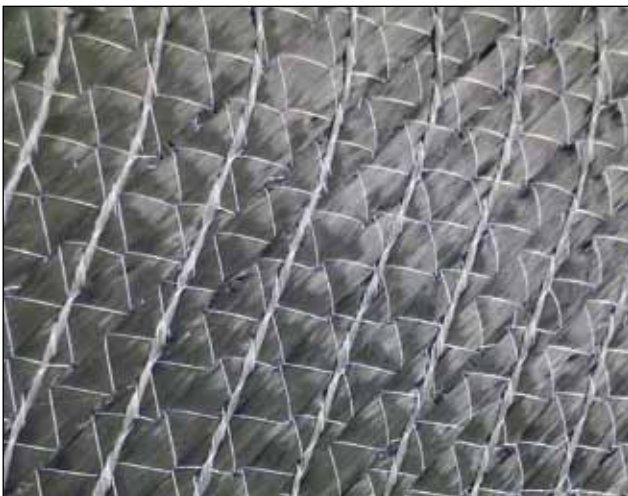
The outstanding and essential difference between the processes of ZSK's Technical Embroidery Systems and techniques like weaving, knitting or even braiding consists into the absolutely free and flexible laying of the media at the 2-dimensional level of the carrier material. The laying is limited only by the physical characteristic of the media.

## LAYING FIBERS

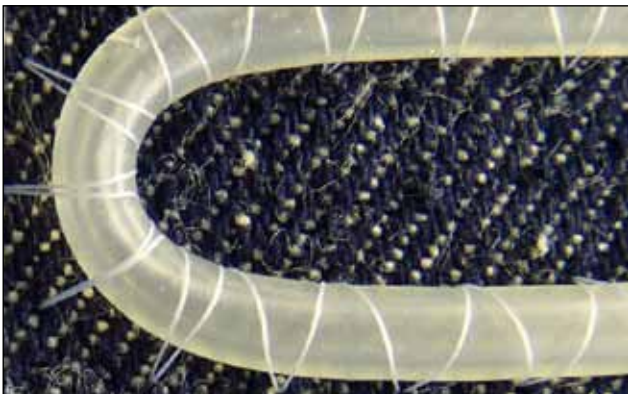
An innovative technology to build up reinforcement fabrics is the free orientation, placing and fixing of reinforcement materials through an embroidery machine. It is already good practice in the production of near net shape preforms for composite parts. The application spectrum covers productions of components or textile structures which requires the stitching of variable geometry ply stacks, where fabrics need to be reinforced locally, or where fabrics must be assembled.

Single laid rovings are fixed to the base material by stitching.

During the process, the base material is moved by the pantograph, enabling to lay rovings in any direction and quantity up to a thickness of 7 mm.



## LAYING TUBES



### TFP - Tailored Fiber Placement

Several fibrous material like carbon, glass, basalt, aramid, natural, thermo-plastic, ceramic fibers or metallic threads can be placed in a near net shape on a carrier material by TFP. Even the placement of different materials at the same time or one after another can be proceed by TFP.

Especially while using the TFP technology for the placement of carbon rovings to create preforms for composite parts, high degree of freedom is an advantage. The rovings can be placed exactly according to the distribution of forces within a structural component. This leads to a higher force absorption with less stacked layers.

100% reproducibility speaks for itself and is accomplished by the following:

- Automatic preform production
- Low mass tolerance
- High dimensional accuracy
- Reliable identical laying roving

This cost effective process is driven by high stitching speed on one hand and multiple laying heads on a machine.

In comparison to other textile technologies the expensive loss of materials is kept to a minimum because of the near net shape production of the product. Accordingly, the problem of waste disposal is very little.

### Tailored Tube Placement (TTP)

can be used to place tubes of several diameters on a textile structure.

Examples of use:

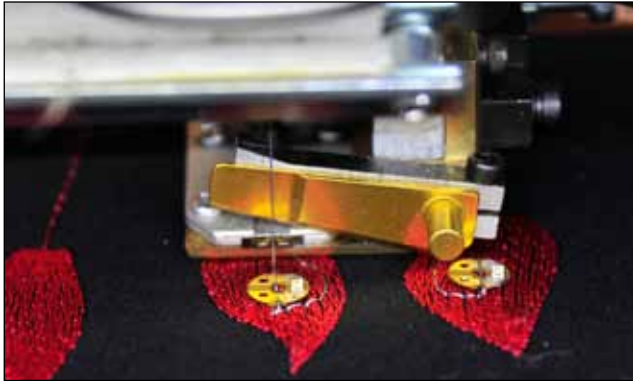
- Integration of tubes into textile reinforced concrete e.g. for heat exchange systems,
- Suits and vests with tubes for cooling purposes,
- Pipe systems for fluids of any kind applied to a textile structure or a flexible carrier material,
- Ducts for electrical cables and connections as a cable harnesses applied to a textile structure or a flexible carrier material.



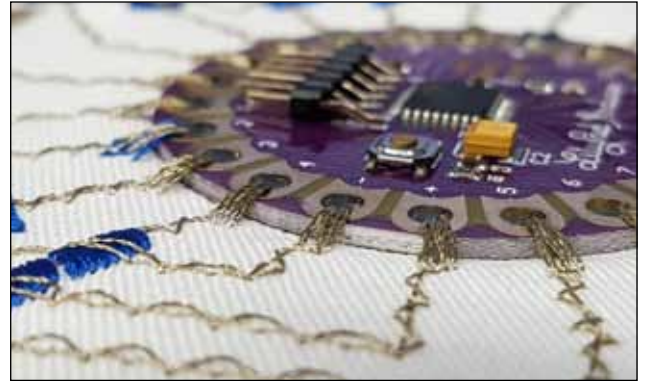
# F-HEAD

The F-Head is the most common used embroidery technology, often referred to as standard embroidery. By using this standard technology for a satin- or running stitch with conductive threads, many applications for Wearables, E-Textiles and Smart Textiles are possible. Due to several available attachments like sequin-, cording- or Hot Air Cutting-device the F-Head can be used for a lot of technical applications.

## Example: Conductive Yarns



Embroidered LED Sequins (Functional Sequin Device - FSD)



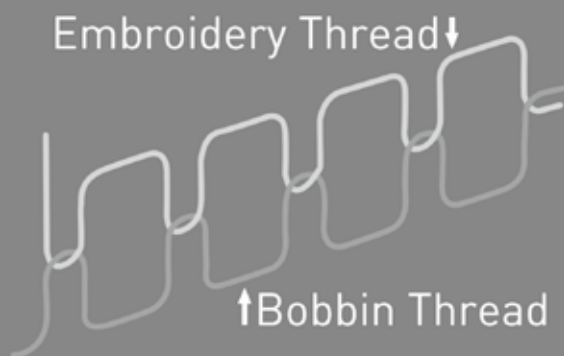
Embr. connections of main board, textile, conductive fiber

## PRINCIPLE OF F-HEAD

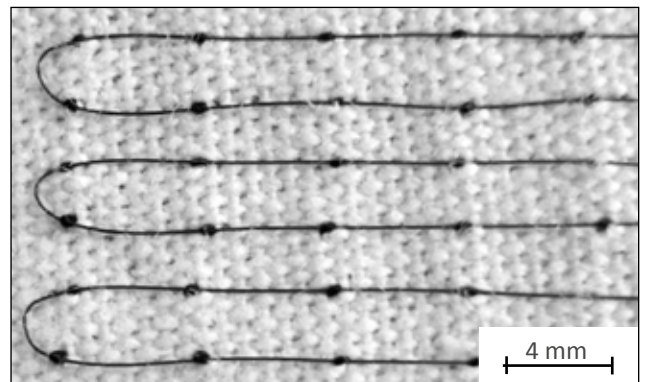
The loop forming at the so-called double lockstitch happens in several steps. The needle leads the embroidery yarn and the hook at the bobbin the lower bobbin thread.

First, the needle will pierce the textile material, at the same time the hook at the bobbin rotates and pick the bobbin thread.

Now the hook pass through the loop of the upper embroidery yarn. The needle leads back and the hook turns further on into the start position.



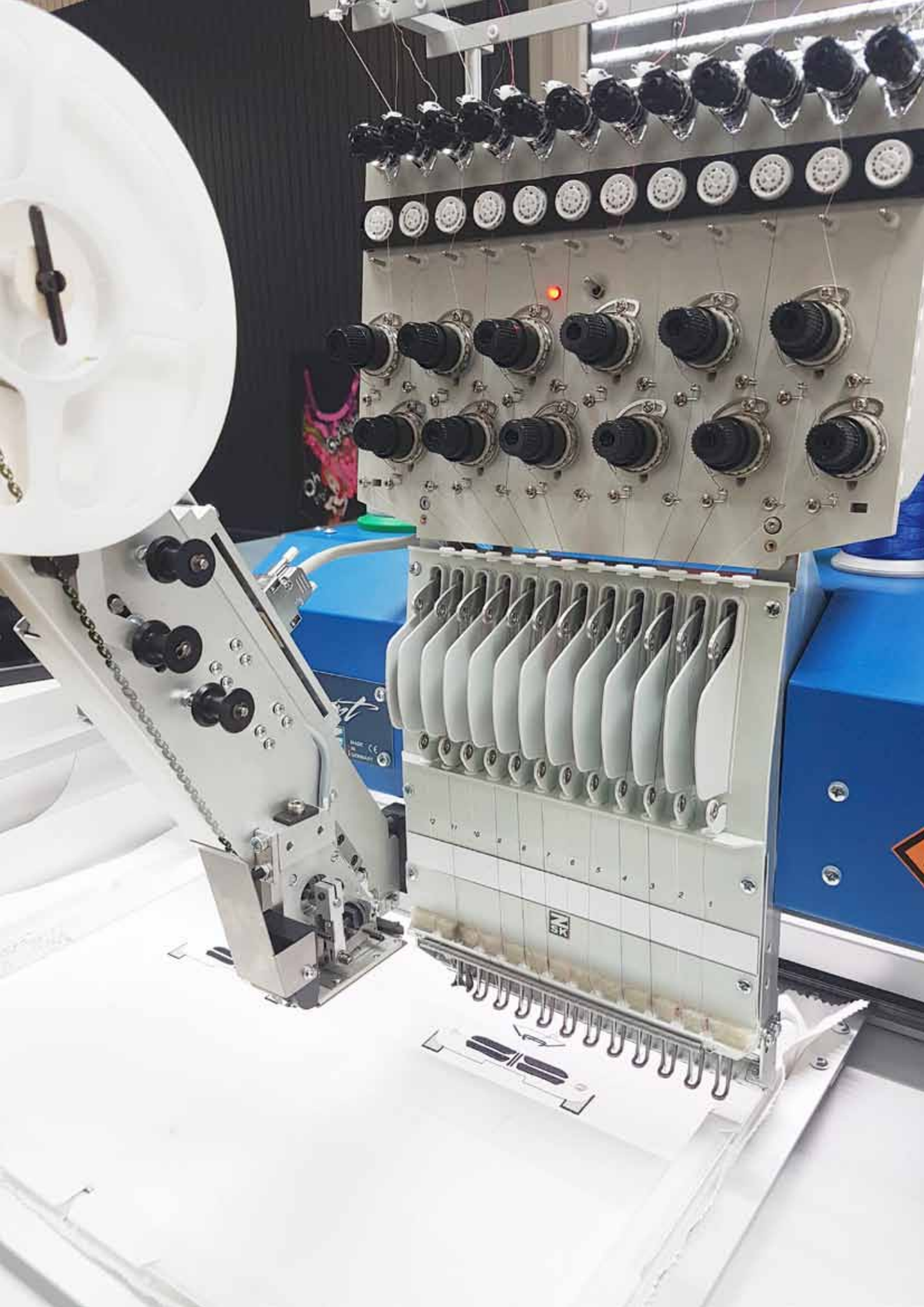
## Example: Embroidery of Wire



Embroidered Nitinol wire (100  $\mu\text{m}$ ) [1]



Embroidered Copper wire (70  $\mu\text{m}$ )





# K-HEAD



The K-Head realizes the so-called moss embroidery. The single thread system creates loops at the surface of the carrier material. Voluminous surfaces will be generated by the compact placement of the stitches.

An actuator system with four separate single motor units supports the customization of parameters like the height of the loops, the presser foot or the inclined position to satisfy the required needs.

Moss embroidery associated with electro conductive yarn is the ideal combination for products from the fields of "Smart Textiles", „Wearables“ and "Medical Textiles". At these groups, textiles are equipped with additional functions like sensors or actors.

## Fields of Application

- Workaday clothes and workwear with integrated electrodes for ECG or EEG for e.g. long-term monitoring of at-risk patients or high-risk groups.
- Custom-fit and high-individualized textile electrodes for e.g. electrophysiological techniques to stimulate dedicated muscle fiber.
- Textiles like braces for electric stimulation therapy at sports, fitness or medical rehabilitation.



Moss Embroidery - Volume by compact Stitches

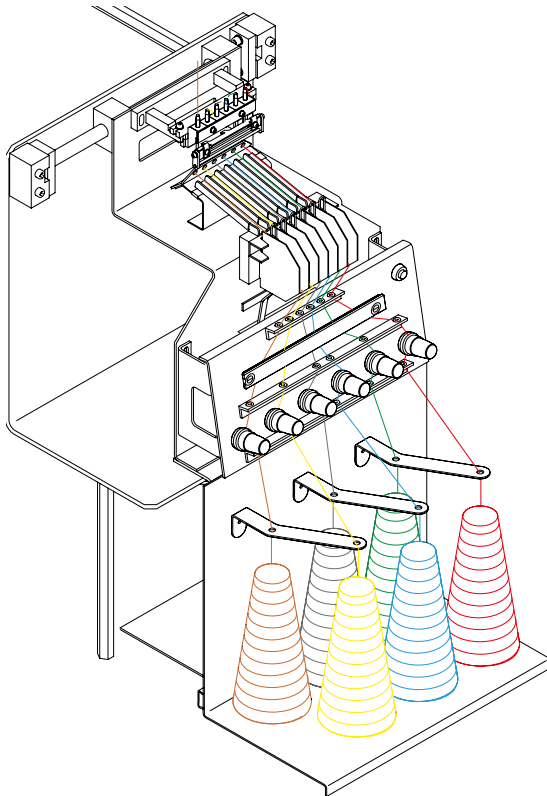


Moss Embroidery - Close Detail



## K-Head Supply System

ZSK Technical Embroidery Systems with K-Head offer a special supply system for the working thread which is positioned below the table. The system holds available six positions to provide fibers or conductive yarns with different characteristics.



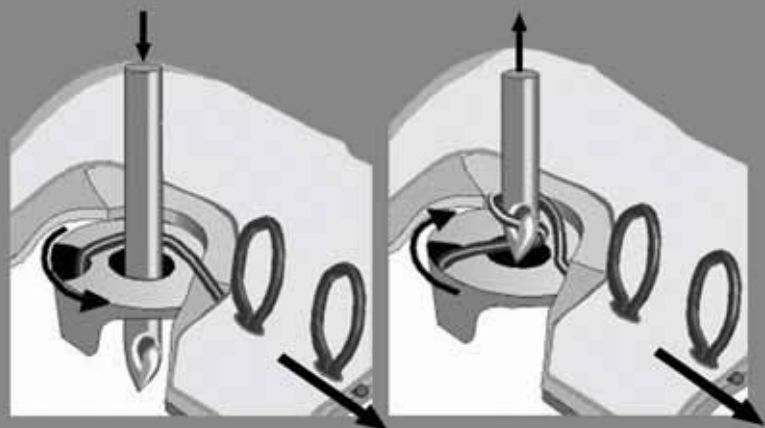
Graphical scheme of K-Head supply system



ANTELOPE.SUIT  
With Moss Embroidered Electrodes for  
Electrical Muscle Stimulation [2]

## PRINCIPLE OF K-HEAD

The moss embroidery machines are built differently than traditional embroidery machines however use a similar embroidery technique. Moss embroidery is created by a one-thread system. In this system, the needle goes through the carrier material (1) and pulls the thread out from under the needle, plate side up. Then, a loop is created by a rotary motion of the needle (2) on the upper side of the carrier material. Repeating this pattern frequently produces a moss-like surface.



# OPTIONS

## 1 Active wire and fiber supply systems

Two supply systems can be installed on each laying head. Each supply system can take wire or fiber rolls up to 10kg. New function to detect end of supplied media.

## 2 Automatic unwinding function

The advantage to supply wires and fibers from big rolls bears the disadvantage that the materials has to be guided to the zig-zag layer by pipes and that limits the possible rotation to 360 degrees. Because of this limitation wires could not be laid in spirals for example. ZSK has solved this problem by an automatic unwinding function!

## 3 Automatic change of different media

The change between two different media like two different wires or fibers and wires is fully automatic. (Patent pending.)

## 4 Pneumatic media trimmer

The pneumatic trimming system cuts all kind of fibers and even stronger wires.

## 5 Wire hit detection system

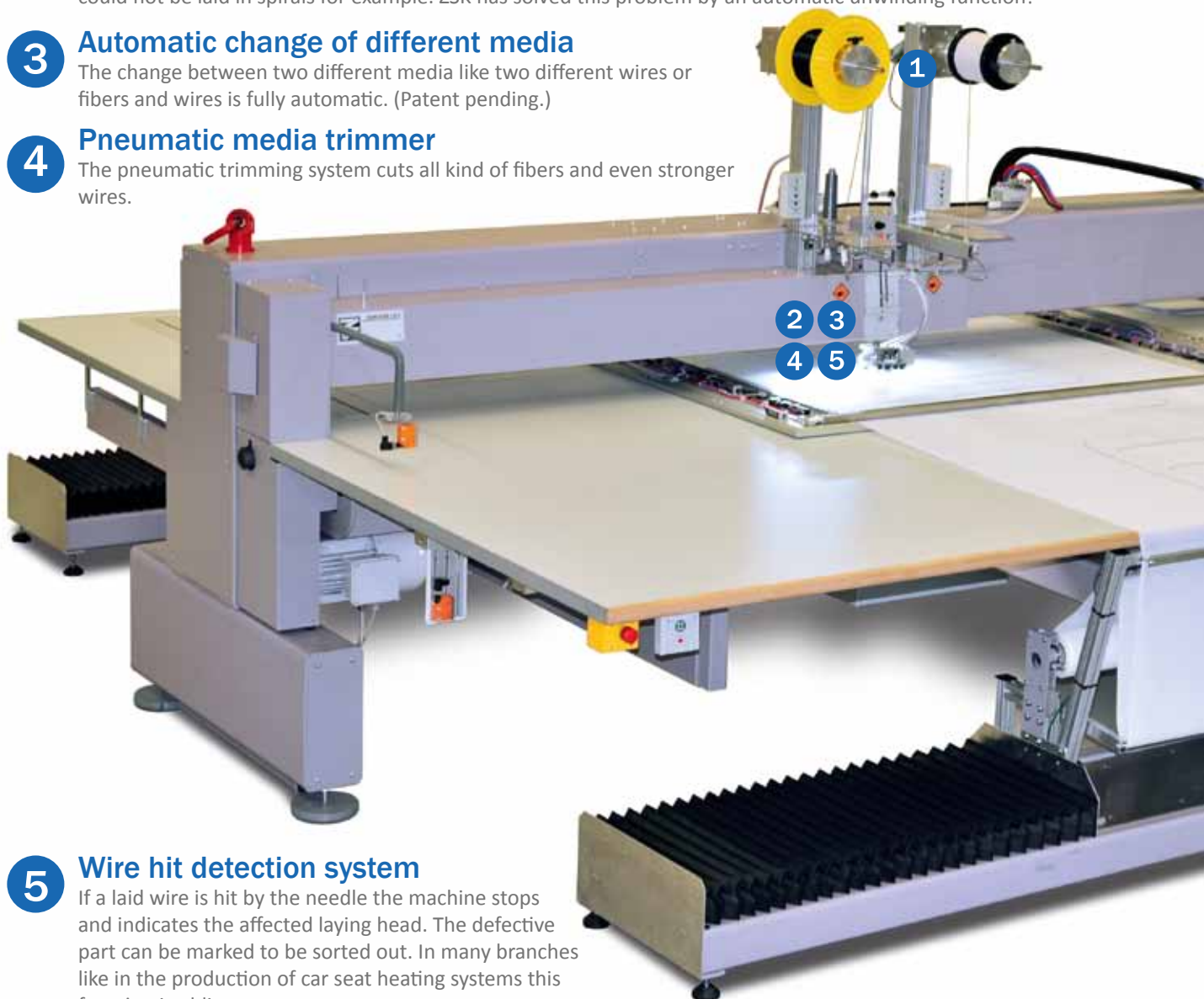
If a laid wire is hit by the needle the machine stops and indicates the affected laying head. The defective part can be marked to be sorted out. In many branches like in the production of car seat heating systems this function is obligatory.

## 6 Fast fiber laying

For large objects a fiber laying speed up to 5m per minute can be reached

## 7 Carbon protection for the electronics

All electronic devices of a ZSK laying machine are protected against carbon dust.





### Pneumatic clamping and stretching system

A very flat designed clamping and stretching system for the carrier material.

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### Automatic pull through system

The carrier material is automatically pulled trough from roll to roll, back to front.

The system is available for all one head laying systems.

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- Carrier material (woven, non woven, foils) up to 140cm wide is pulled automatically from back to front.
- The roll and re-roll stands follow the side movement of the pneumatic frame which allows to transport and re-clamp the carrier material in any position of the frame.
- Transporting and re-clamping is possible in back to front and vice versa direction in the middle of a wire laying design.
- The length of a wire laying design is just limited to the length of the carrier material available on the roll.
- The unrestricted changing of the transporting direction of the carrier material allows to have the start and end of a wire for example at one point for easy connection.

### Semi automatic pull through system

In case of multi head laying systems (up to 11 laying heads) the carrier material is pulled trough from left to right. In connection with a pneumatic clamping and stretching system and the motor supported roll up the loading time takes less then 2 minutes.

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### Automatic bobbin changer

The pneumatic bobbin changer for the under thread is equipped with a magazine for 7 full and one empty bobbin for up to 8 hours of running time.

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**SGW 0100-1375-1200**

## ADVANTAGE HIGH LEVEL OF AUTOMATION

A significant higher efficiency can be achieved at the production of technical textiles by using our advanced automation techniques. Quality, production output and labour costs will benefit on a high level from the options which are available for any machine of ZSK's Technical Embroidery Systems.

# MACHINES

## Machine models and laying sizes for technical embroidery machines

### W - Head

	JCW 0100-500-700	JGW 0100-650-700 <sup>1</sup>	JGW 0200-550-700 <sup>3</sup>
No of heads	1	1	2
Head distance	-	-	550 mm / 21.653"
Max. laying depth	600 mm 23.622"	600 mm - multiple 23.622" - multiple	600 mm 23.622"
Max. laying width	450 mm / 17.716"	650 mm / 25.59"	2 x 550 mm / 2 x 21.653" or 1 x 1,100 mm / 43.3"
Machine net size l/d	1,570 x 1,730 mm 61.711" x 68.11"	2,000 x 1,800 mm 78.74" x 70.866"	3,440 x 1,840 mm 135.433" x 72.44"

	SGW 0100-1375-1000	SGW 0100-1375-1200 <sup>1</sup>	SGW 0100-1375-2000 <sup>3</sup>
No of heads	1	1	1
Head distance	-	-	-
Max. laying depth	900 mm / 35.433"	1,100 mm - multiple 43.3" - multiple	1,900 mm / 74.8"
Max. laying width	1,350 mm / 53.149"	1,200 mm / 47.244"	1,350 mm / 53.149"
Machine net size l/d	4,100 x 2,460 mm 161.417" x 96.85"	4,100 x 3,800 mm 161.417" x 149.6"	4,100 x 4,460 mm 161.4174" x 175.59"

	YCW 0600-1180-1500 <sup>1</sup>	YGW 0800-800-1000	ZBW 1100-750-1200 <sup>2</sup>
No of heads	6	8	11
Head distance	1,180 mm / 46.456"	800 mm / 31.496"	750 mm / 29.527"
Max. laying depth	1,400 mm / 55.118"	900 mm / 35.433"	900 mm / 35.433"
Max. laying width	6 x 700 mm 6 x 27.559"	8 x 800 mm 8 x 31.496"	11 x 750 mm 11 x 29.527"
Machine net size l/d	8,900 x 3,600 mm 350.393" x 141.732"	9,275 x 2,460 mm 365.157" x 96.85"	12,700 x 2,860 mm 500" x 112.598"

	ZCW 0400-1800-1500 <sup>2</sup>	ZCW 0800-900D-1500 <sup>2</sup>	ZCW 0800-900D-2000
No of heads	4	8	8
Head distance	1,800 mm / 70.866"	900 mm / 35.433"	900 mm / 35.433"
Max. laying depth	1,200 mm / 47.244"	1,200 mm / 47.244"	1,900 mm / 74.8"
Max. laying width	4 x 1,800 mm 4 x 70.866"	8 x 900 mm / 4 x 1,800 mm 8 x 35.433" / 4 x 70.866"	8 x 900 mm / 4 x 1,800 mm 8 x 35.433" / 4 x 70.866"
Machine net size l/d	13,000 x 3,460 mm 511.811" x 136.22"	13,000 x 3,460 mm 511.811" x 136.22"	11,560 x 4,460 mm 455.118" x 175.59"



## Combi Head - F +W

	JCZA 0109-550-700	JGZA 0109-550-700 <sup>3</sup>	SGZA 0109-825-1200
No of heads	1 + 1	1 + 1	1+1
Head distance (W-W   F-W)	-   275 mm / -   10.82"	-   550 mm / -   21.653"	-   550 mm / -   21.653"
Max. laying depth	600 mm / 23.622"	600 mm / 23.622"	1,100 mm / 43.3"
Max. laying width	550 mm / 21.653"	550 mm / 21.653"	825 mm / 32.48"
Machine net size l/w	2,000 x 1,730 mm 78.74" x 68.11"	3,440 x 1,840 mm 135.433" x 72.44"	4,100 x 2,460 mm 161.417" x 96.85"

	YGZA 0809-800-1000	ZCZA 0809-900-1500	ZCZA 0809-900-2000
No of heads	8 + 8	8 + 8	8 + 8
Head distance (W-W   F-W)	800 mm   350 mm 31.496"   13.779"	900 mm   450 mm 35.433"   17.716"	900 mm   450 mm 35.433"   17.716"
Max. laying depth	900 mm / 35.433"	1,400 mm / 55.118"	1,900 mm / 74.8"
Max. laying width	800 mm / 31.496"	900 mm / 35.433"	900 mm / 35.433"
Machine net size l/w	9,275 x 2,460 mm 369.09" x 96.85"	11,560 x 3,460 mm 455.118" x 136.22"	11,560 x 4,460 mm 455.118" x 175.59"

## Combi Head - F + K

	JCHA 0109-550-700		SGVA 0109-825-1000
No of heads	1 + 1	No of heads	1 + 1 + 1
Head distance (K-K   F-K)	-   275 mm -   10.82"	Head distance (F-F   F-K   K-W)	-   275 mm   275 mm -   10.82"   10.82"
Max. embroidery depth	700 mm / 27.559"	Max. laying depth	900 mm / 35.433"
Max. embroidery width	550 mm / 21.653"	Max. laying width	825 mm / 32.48"
Machine net size l/w	2,000 x 1,730 mm 78.74" x 68.11"	Machine net size l/w	4,100 x 2,460 mm 161.417" x 96.85"

## Combi Head - F + K + W

## F - Head

	SPRINT 6 - LED
No of heads	1
Head distance	-
Max. embroidery depth	220 mm / 8.66"
Max. embroidery width	420 mm / 16.535"
Machine net size l/w	1,040 x 985 mm 40.944" x 38.779"

- <sup>1</sup> Pull Through System - Roll to Roll - back to front
- <sup>2</sup> Pull Through System - Roll to Roll - left to right
- <sup>3</sup> System on Request



# ABOUT

**ZSK Technical Embroidery Systems is a division of ZSK Stickmaschinen GmbH, the leading German manufacturer of industrial embroidery machines „Made in Germany“.**

With great expertise and experience in the textile machine construction, the company from the Lower-Rhine area has developed a broad range of applications for its embroidery machines.

Beside large machines for the challenges at the mass production and embroidery machines to individualize textiles, ZSK Stickmaschinen GmbH manufactures machines for laying and fixing fibres, wires and tubes, the so-called TECHNICAL EMBROIDERY SYSTEMS.

ZSK has been shaped this sector with the development of customized embroidery

solutions since the 1990's. Today ZSK's TECHNICAL EMBROIDERY SYSTEMS enable the free orientated laying of fibers and wires in a 2-dimensional space on flexible carrier material.

TAILORED FIBER PLACEMENT, meaning the laying according to the distribution of forces within a structural component is a major advantage of this process.

With innovative applications like active wire and fiber supply systems for industrial demands, automatic pull-through systems for the carrier material or a wire hit detection system ZSK TECHNICAL EMBROIDERY SYSTEMS achieve a high level of automatization and efficiency.



# SERVICE



## Hotline

Sales and service partner in over 75 countries worldwide will help you when you need it.



## Training Courses

Training courses for customers and partners on location or at ZSK headquarter training center.



## Spare Parts

Guaranteed fast and global delivery and installation for over 10.000 available spare parts.



## Technical Support

Trained experts and technicians that speak your language in more than 75 countries.

Email: [service@zsk.de](mailto:service@zsk.de)



## ZSK Technical Embroidery Systems

*A Division of ZSK Stickmaschinen GmbH*

Magdeburger Str. 38 - 40  
47800 Krefeld  
Germany

Online: [www.technical-embroidery.com](http://www.technical-embroidery.com)

Email: [contact@technical-embroidery.com](mailto:contact@technical-embroidery.com)



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- [1] Hörr, M.; Gries, T.; Jockenhövel, S.: Stickten zur Funktionalisierung von Textilien. TVP : Fachzeitschrift für Textilveredlung und Promotion (2015), H. 4, S. 58-61
- [2] Wearable Life Science GmbH, Frankfurt am Main, Germany

ZSK - DIE STICKMASCHINE.